Optimizing the total-body skin exam: An observational cohort study

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Background: Total-body skin examinations (TBSEs) are commonly performed in clinical practice. There is limited research on best practices for performing a TBSE.

Objective: To optimize the TBSE.

Methods: We performed an observational cohort study by video recording 5 dermatology faculty and 5 residents conducting their regular TBSE on both a healthy male and female patient. Examination time, physician movements, patient movements, sequence of body parts examined, and body parts missed were analyzed by using an analytic hierarchy process matrix. Differences were evaluated by a *t* test of unequal variance. *P* values $< .05$ were deemed significant.

Results: We identified an optimal format for conducting a TBSE that is efficient and accurate.

Limitations: This study was conducted with only standard healthy examiners and patients, rather than individuals with a variety of physical or mental disabilities. The structure of the study was not hypothesis driven, and we assumed that the engineers observing the physicians performing the examination would identify the most optimal TBSE.

Conclusion: Our results indicate that a standardized process of performing a TBSE minimizes the chance of missing a body area. This could also have implications on teaching a standardized TBSE to medical students, residents, and physicians. (J Am Acad Dermatol 2019;81:1115-9.)

Key words: complete skin examination; detection; screening; skin cancer; total-body skin examination.

The US Preventive Services Task Force concluded that current evidence is insufficient to assess the balance of benefit versus harm of a visual skin examination for skin cancer screening.[1] The total-body skin examination (TBSE) is a full visual assessment of the entirety of a patient's skin surfaces. Although evidence is limited on the benefits of routine TBSE for skin cancer detection, TBSE is helpful for detecting cutaneous disease and is well received by patients.[2-6] We used engineering biomechanic principles of efficiency, movement, and process to develop a standardized and optimal TBSE.

Abbreviations used:

AHP: analytic hierarchy process
TBSE: total-body skin examination

METHODS

We completed an observational cohort study by video recording 5 dermatology faculty members and 5 residents conducting their regular TBSE on both a male and female standard participant wearing a patient gown and undergarments. Examination time, physician movements, patient movements,

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sequence of body parts examined, and body parts missed were analyzed. Effective time was defined as time spent examining body parts, whereas total time was defined as effective time plus time wasted performing unnecessary movements. By dividing effective time by total time, we determined the time efficiency of a TBSE (Table I). Movement was defined as a change in position or physical location. Movements were classified as minor or major. Minor movements included standing up, squatting, sitting down, bending over, and tilting head. Major movements included walking to and around the bed, rolling over, and laying down. Minor and major movements were calculated for both the examining physician and patient for both male and female standard participants. Process (ie, order of examined body parts) was documented for each skin examination.

Differences were evaluated by a *t* test of unequal variance. *P* values $< .05$ were deemed significant. An analytic hierarchy process (AHP) matrix was scored by ranking 4 specifications relative to each other: time efficiency, accuracy (taking into account body parts not visualized), provider and patient movements, and process. This AHP created a weighted score for each factor, with time efficiency being deemed the most important factor because it directly involves the other factors, accuracy, movement, and process (ie, poor process and poor movement will lead to poor time efficiency). Weights were determined by using an AHP matrix, in which numerical scores were assigned to each factor on the basis of importance, determined through a series of pairwise comparisons. By evaluating these 4 specifications, our engineers determined an optimal process for the TBSE. The Human Subjects Protection Office of our institution determined that this study was exempt from formal institutional review board review.

CAPSULE SUMMARY

- There is limited information on how a total-body skin examination should be performed.
- Adopting a standardized total-body skin examination can increase time efficiency and minimize the chance of missing a body area.

RESULTS

TBSE time ranged 75-243 seconds. There was no statistical differences between total time examining a patient versus physician experience (faculty vs resident), but there was significant variability between providers in their efficiency

Table I. Effective time, total time, and time efficiency for examiners in different stages of their careers

Examiner	Examiner experience level	Head		Chest		Back		Arms		Legs		Effective time, sec		Total time, sec		Time efficiency, %	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1	Early career	42	56	1	9	8	16	16	24	26	37	93	142	154	201	60.4	70.6
2	Late career	19	26	6	10	13	12	21	14	15	21	74	83	109	125	67.9	66.4
3	Late career	60	60	10	8	24	27	26	27	22	35	142	157	184	210	77.2	74.8
4	1st-year resident	21	33	7	8	5	5	11	20	17	19	61	85	114	103	53.5	82.5
5	3rd-year resident	18	40	3	6	9	9	11	17	17	15	58	87	88	119	65.9	73.1
6	2nd-year resident	27	44	4	7	5	9	14	26	16	21	66	107	94	138	70.2	77.5
7	2nd-year resident	27	52	4	4	9	7	5	16	9	14	54	93	75	129	72	72.1
8	1st-year resident	23	75	8	7	6	12	18	32	35	40	90	166	127	212	70.9	78.3
9	Mid career	70	85	10	8	8	6	36	28	34	27	158	154	215	177	73.5	87
10	Early career	45	92	5	12	12	18	35	27	29	3	126	152	243	235	51.9	64.7
SD		18.3	22	3	2.2	5.6	6.7	10.3	6	8.7	11.6	37.4	34.4	46.8	47.3	8.5	6.9
Variance		334.6	484.2	8.8	4.8	31.7	45	106.2	35.9	75.8	134.8	1397.5	1184.7	3246.2	2239.9	72.1	47.6
Mean		35.2	56.3	5.8	7.9	9.9	12.1	19.3	23.1	22	23.2	92.2	122.6	140.3	164.9	66.3	74.7

F, Female; *M*, male; *SD*, standard deviation.

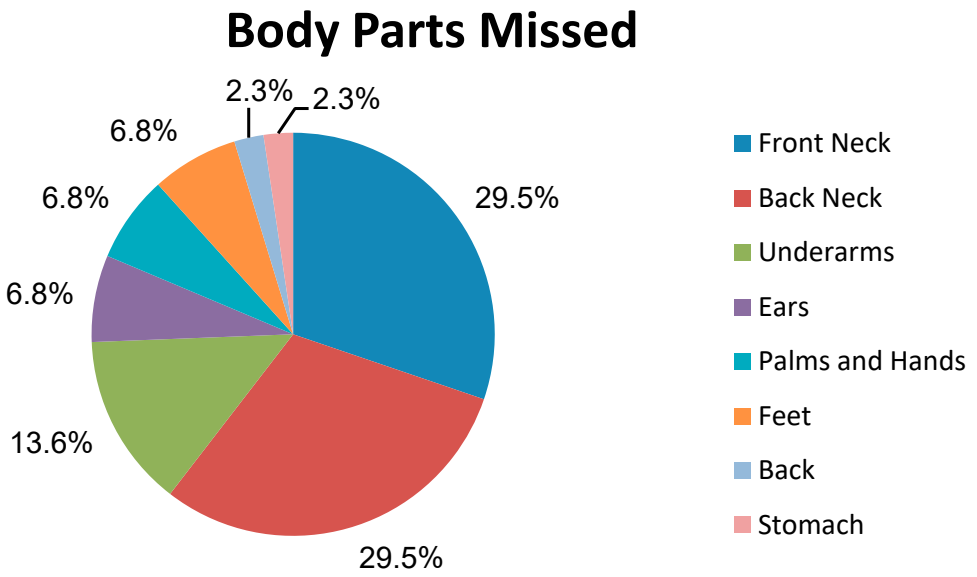

Fig 1. Body parts missed by examiners. The percentage indicates the frequency that body part was missed in comparison with all body parts missed.

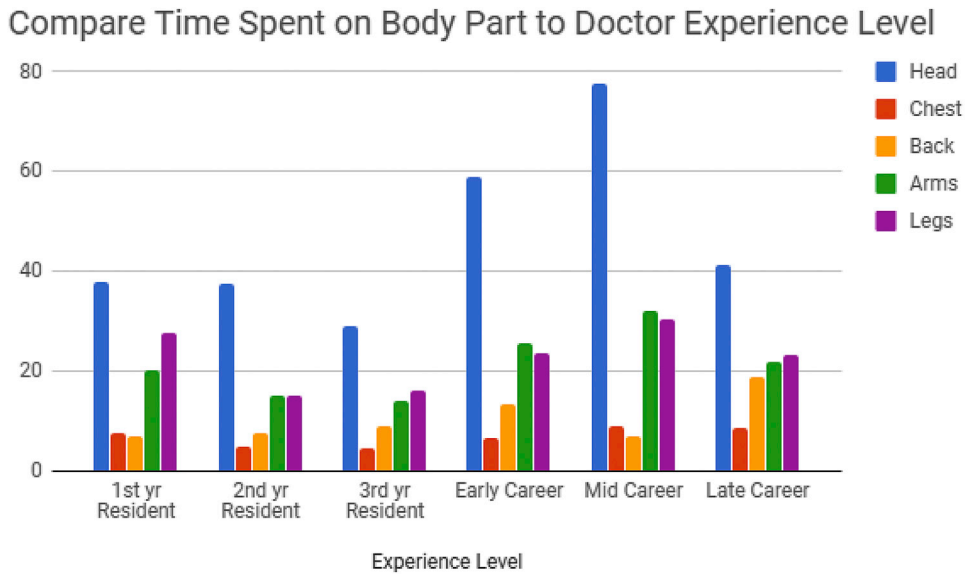

Fig 2. Time spent on each body part by experience of examiner.

and order of examination. Effective time per body part (percentage of time examining a given body part divided by the total time of exam) was highest for the head (41%), followed by the legs (22%), and arms (20%) (Table I). The neck had the highest frequency of being missed during a TBSE (29.5%), followed by the underarm region (13.6%) (Fig 1). There was no correlation between doctors spending more or less time on a body part as they gained experience (Fig 2). In total, 48.1 seconds were lost on average in the male patient examination, and 42.3 seconds in the female patient examination due to unnecessary movements on part of the physician and participant (Fig 3). Average efficiency for examining the male and female patients were 66.3% and 74.7%, respectively; in other words, about one third of the examination time for the male patient and one

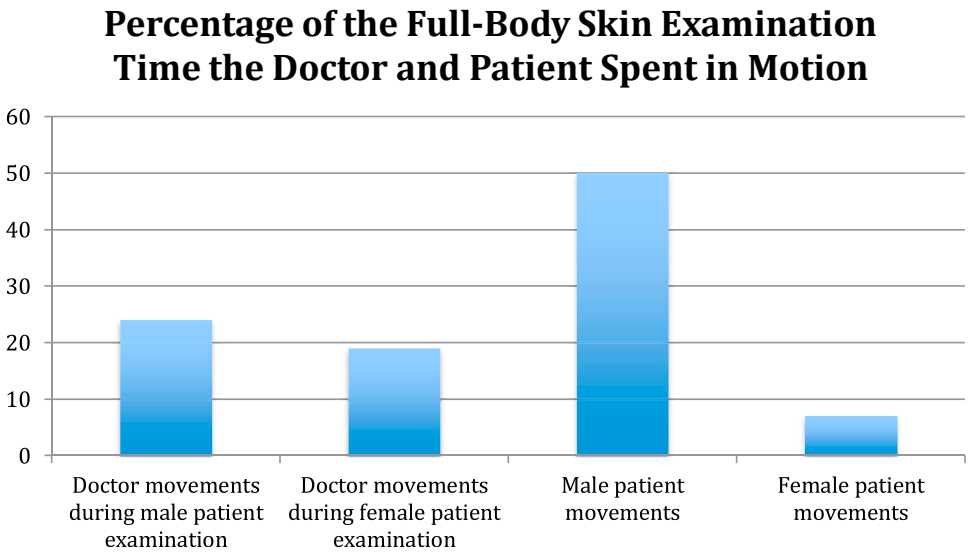

Fig 3. Percentage of the total-body skin examination time the examiner and patient spent in motion.

fourth of time for the female patient were wasted on unnecessary movements.

Differences in doctor and patient movements were compared between male and female patient examinations. The mean number of movements was greater in the male patient examination than in the female patient examination for both the doctor (7.0 movements, P = .0004) and patient (6.2 movements, P = 0). The mean number of repeated movements by the doctor was 1.8 for the male patient and 1.0 for the female patient. There was no correlation between level of experience and doctor movements. A large percentage of the TBSE was spent in motion for both the physician and patient (Fig 3).

After analyzing the data, we formulated an optimal standardized TBSE (Fig 4) taking into account time efficiency, missed body parts, and movements. Our proposed process for the TBSE begins with the patient sitting, while the dermatologist examines the anterior face, scalp, neck, chest, flank, stomach, arms, hands, legs, and feet of the patient. The patient then stands and turns away from the examiner to have the posterior scalp, neck, back, posterior arms and legs examined.

DISCUSSION

We propose a standardized TBSE that has the capacity to increase accuracy and time efficiency in examining all body parts. This approach provides a uniform method for teaching the TBSE to health care professionals. To our knowledge, no prior studies have applied engineering principles to optimize a physical examination in other specialties. Our study demonstrated significantly higher numbers of movements for both the patient and doctor during the male patient examination versus the female patient examination for reasons that require further validation and investigation. We suggest that patients be informed of the outline of the TBSE and be given instructions regarding clothing items to remove before the examination to maximize time efficiency while respecting privacy and comfort. Limitations of our study include lack of hypothesis building in developing an examination strategy, small sample size, and the use of healthy participants and examiners. Further study of different relative positions between patient and examiner, ergonomic impact, and approaches to patients with different disabilities is needed to identify modifications that might be useful in particular situations. Implementing and teaching the standardized TBSE to medical students, dermatologists, and primary care clinicians, along with assessment of efficiency, accuracy, and time, may be important steps that help the US Preventive Services Task Force validate the benefit of the TBSE.

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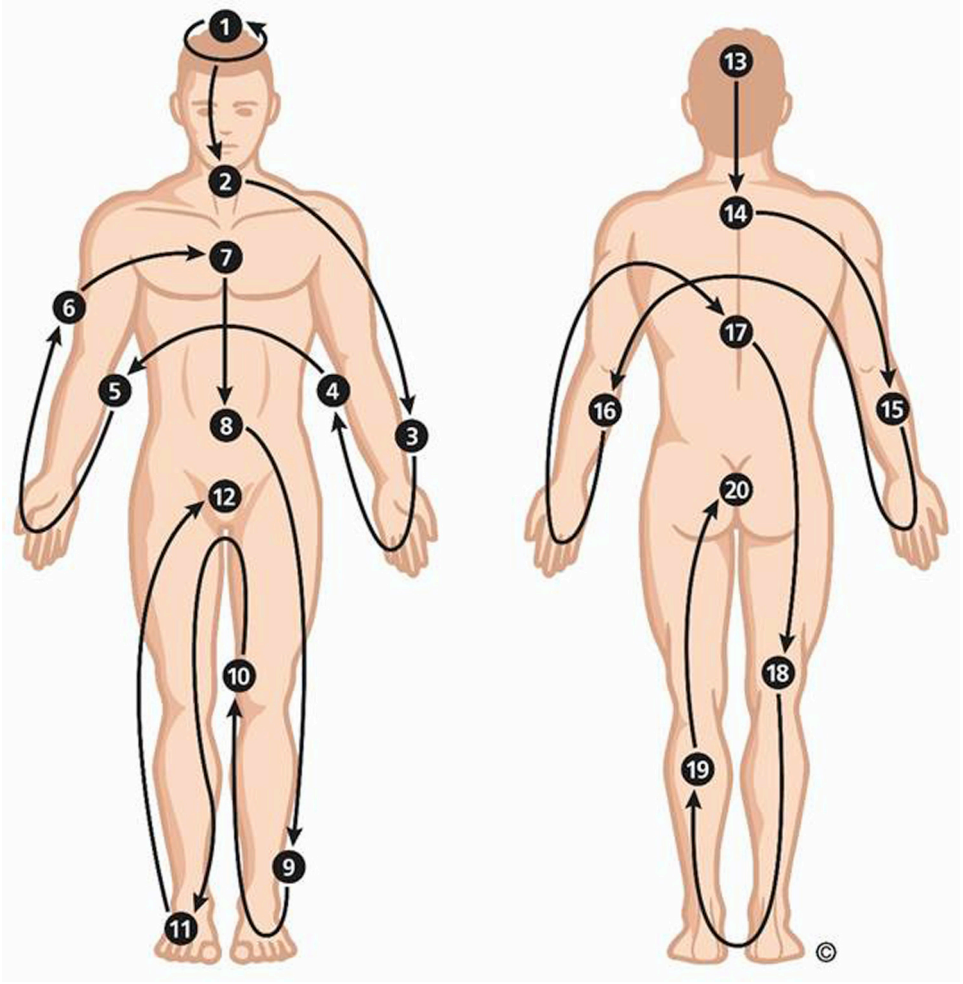

Fig 4. A standardized sequence of steps to perform to optimize total-body skin examination time efficiency. The front examination, in sequence: 1) scalp and through hair, 2) down the face and anterior neck, 3) dorsal left arm, 4) ventral left arm and left flank, 5) right flank and ventral right arm, 6) dorsal right arm, 7) center chest, 8) abdomen, 9) anterolateral left leg and plantar foot, 10) anteromedial left and right leg, 11) plantar foot and anterolateral right leg, and 12) groin. The patient stands up and turns to the back, and the back examination occurs in sequence: 13) occipital scalp, 14) upper back, 15) back of right arm, 16) back of left arm, 17) center back, 18) back of right leg, 19) back of left leg, and 20) buttocks.

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